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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/590,011

08/21/2006

Takeshi Hikata

070456-0119

7075

20277 7590 09/14/2010  
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EXAMINER

HORNING, JOEL G

ART UNIT

PAPER NUMBER

1712

MAIL DATE

DELIVERY MODE

09/14/2010

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/590,011	<b>Applicant(s)</b> HIKATA, TAKESHI	
	<b>Examiner</b> JOEL G. HORNING	<b>Art Unit</b> 1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2010.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3-6 and 8-15 is/are pending in the application.
- 4a) Of the above claim(s) 8-15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 2<sup>nd</sup>, 2010 has been entered.

### ***Election/Restrictions***

2. Claims 8-15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on May 29<sup>th</sup>, 2009.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. **Claims 1 and 3-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Delzeit (US 6858197).

The instant claims are directed towards a catalyst structure ***that is shaped as a pipe with its upper surface capable of serving as a crystal growth surface,*** which can be used to make carbon nanotubes by vapor deposition, which includes a catalytic material which forms a ring on a crystal growth surface, ***and at least part of a side of said pipe shaped structure has a non-catalytic material with substantially no catalytic activity with respect to a growth of said crystalline carbon.***

Delzeit is directed towards a catalyst structure for depositing carbon nanotubes by a vapor deposition method, which includes a surface with a layer of catalyst material which is formed into a desired pattern (abstract),.

Delzeit further teaches that a catalyst structure having a multilayer catalyst material with an even surface and a first layer of aluminum (which is exposed on the outside of the structure and not taught to be catalytic), a second layer of catalytic iron, cobalt, or nickel covered by a third layer of catalytic molybdenum, can then be coated with an overlayer material (which puts it exposed on the outside [as shown each layer is exposed on the outside] as well as the top side of the catalyst structure, see figure 4) of silver (**claims 3 and 4**). This overlayer material is not taught to be catalytic and does not appear to contribute to catalysis, instead having the function of coating the outside of the grown nanotubes (col 4 line 57 through col 5, line 3). Additionally, since applicant claims that silver can be the non-catalytic

Art Unit: 1712

material, it must have "substantially no catalytic activity with respect to a growth of said crystalline carbon." Hence the multilayer structure of the crystal growth surface is composed of catalytic (iron, cobalt, nickel and/or molybdenum) and non-catalytic (aluminum and silver) materials (**claim 5**).

Regarding the shape of the pattern, Delzeit further teaches that the structure of the catalyst can be formed into a wide variety of shapes, even numbers or letters, such as the number 8 which is a two pipe structure (fig 2G, col 4, lines 23-41).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to create the multilayer molybdenum catalyst layer with the silver non-catalytic layer on the top side of the structure in the shape of a pipe, which would make the catalyst in the shape of a ring, since these materials are explicitly taught to be suitable for the catalyst material and the shape is explicitly taught to be a suitable shape for the catalyst material (**claim 1**).

Furthermore, given the teaching of Delzeit of forming the catalyst into the shape of letters and numbers, it would have been readily apparent to a person of ordinary skill in the art at the time of invention to make the catalyst shape into any letter or number shape, including the letter "O" or the number zero, which are (along with many other numbers and letters) considered "pipe" shapes and would produce ring shaped catalyst layers (**claim 1 alternate basis**).

4. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Delzeit (US 6858197) in view of Fan et al (Science vol 283, pages 512-514, (1999)).

The instant claim requires that the crystal growth surface of the catalyst be oxidized.

Art Unit: 1712

Delzeit teaches using iron as the nanotube catalyst (abstract), but does not teach oxidizing its surface.

However, Fan et al is also directed towards patterning and vapor deposition of carbon nanotubes (abstract) by selective deposition of iron as a catalyst material, which then has its surface oxidized (page 512, col 2, lines 1-10). Fan et al further teaches that the resulting iron oxide material acts as a suitable catalyst to decompose precursor vapors so that they then form carbon nanotubes (page 513, col 1, lines 1-5).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to substitute the iron catalyst of Delzeit with the iron oxide catalyst of Fan as a known alternative catalyst material known to be suitable for the deposition of carbon nanotubes which would produce predictable results (**claim 6**).

#### ***Response to Amendment***

5. In response to applicant's amendment to claim 1, requiring that the non-catalytic material be part of the pipe shape, the 102(b) rejection over Dai et al is withdrawn.

#### ***Response to Arguments***

6. Applicant's arguments with respect to claims 1 and 3-6 have been considered but are not convincing in view of the new ground(s) of rejection necessitated by amendment.
7. Applicant argues that Delzeit does not make it obvious to produce "a catalyst structure in the shape of a pipe with its upper surface serving as a crystal growth surface, and at least part of a side of the structure shaped as a pipe has a non-catalytic material with substantially no catalytic activity with respect to the growth of

Art Unit: 1712

crystalline carbon.” As found in the amended rejection, the examiner has mapped the teaching of the art to the new claim features. The examiner would like to note that though this interpretation was not applied previously, the non-catalytic silver and aluminum are shown in figure 4 to both be exposed on the outside of the catalyst structure and so meet the amended claim limitations in an additional way.

8. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).
9. In response to applicant's argument that Delzeit does not include a multilayer structure with catalytic and non-catalytic material, Delzeit teaches a structure with four layers, two of which are catalytic and two of which are non-catalytic, so it appears to meet the claim limitations.

### **Conclusion**

10. No current claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

Art Unit: 1712

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./  
Examiner, Art Unit 1712

/David Turocy/  
Primary Examiner, Art Unit 1715